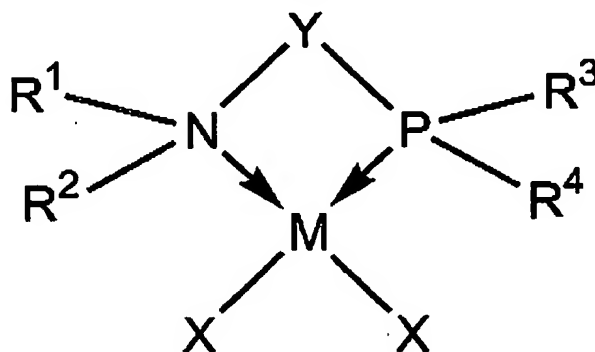


**Listing of Claims**

The listing of claims below replaces all prior versions, and listings, of claims in this application:

1. (Canceled)

2. (Currently Amended) A composition of matter with the following formula:



wherein

- (a)  $M$  is a Group-8, -9, or -10 transition metal, excluding palladium,
- (b)  $N$  is nitrogen;
- (c)  $P$  is phosphorus;
- (d)  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are hydrocarbyl radicals;
- (e)  $Y$  is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long; and
- (f) each  $X$  is independently an abstractable ligand selected from the group consisting of hydride radicals; hydrocarbyl radicals; hydrocarbyl-substituted radicals.

organometalloid radicals; aryloxy, amide, or phosphide radicals; or the two X's are connected to form a 3-to-50-atom metallacycle ring.

3. (Previously Presented) The composition of matter of Claim 2 wherein  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are  $C_1$ - $C_{40}$  hydrocarbyls.

4. (Previously Presented) The composition of matter of Claim 3 wherein  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are  $C_1$ - $C_{30}$  hydrocarbyls.

5. (Previously Presented) The composition of matter of Claim 4 wherein  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

6. (Previously Presented) The composition of matter of Claim 5 wherein  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are methyl, ethyl, propyl, butyl, cyclohexyl, phenyl, tolyl, benzyl, or phenethyl.

7. (Canceled)

8. (Canceled)

9. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are dimethylamino, diethylamino, methylethylamino, phenoxy, or benzoxy.

10. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl,

dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, or tolyl.

11. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently allyl, or 1,1-dimethyl allyl.

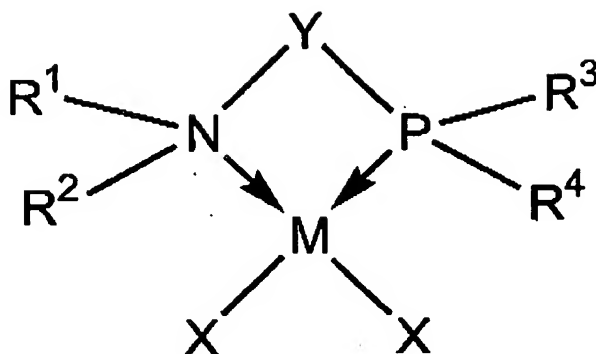
12. (Currently Amended) The composition of matter of Claim 2 wherein M is selected from the group consisting of ~~from~~ nickel, iron, cobalt, platinum, ruthenium, rhodium, and iridium.

13. (Previously Presented) The composition of matter of Claim 12 wherein M is iron, nickel, or cobalt.

14. (Previously Presented) The composition of matter of Claim 12 wherein Y is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penenylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals.

15. (Currently Amended) The composition of matter of Claim 2 14-wherein Y is biphenyl.

16. (Currently amended) A composition of matter with the following formula:



wherein

M is a Group-8, -9, or -10 transition metal, excluding palladium,

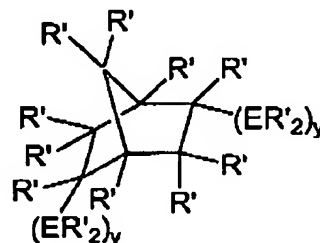
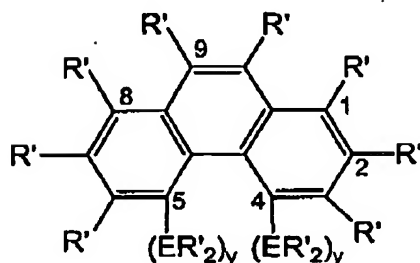
N is nitrogen;

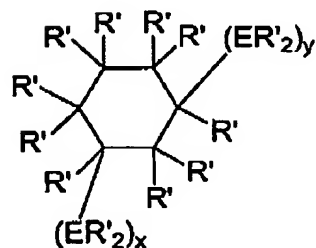
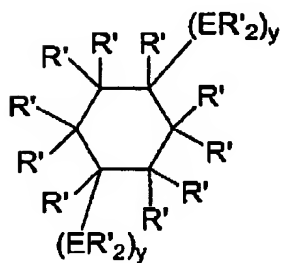
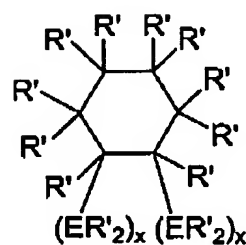
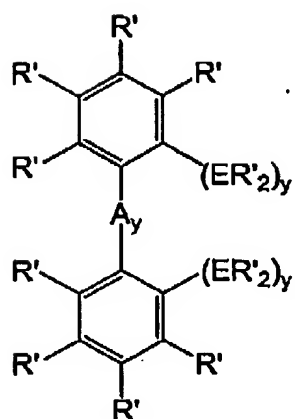
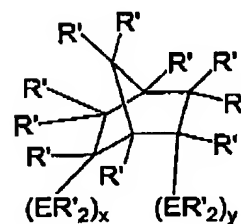
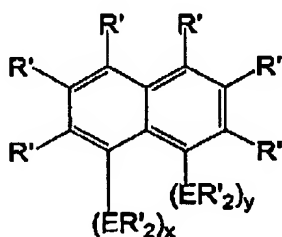
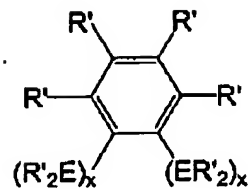
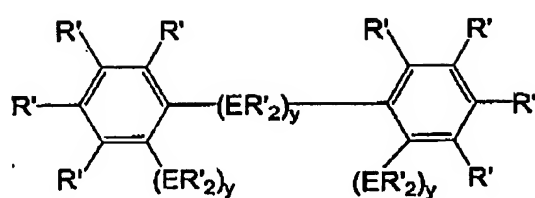
P is phosphorus;

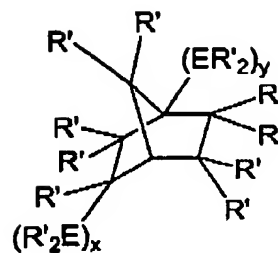
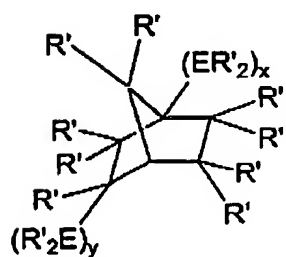
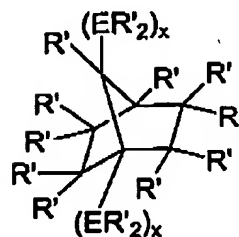
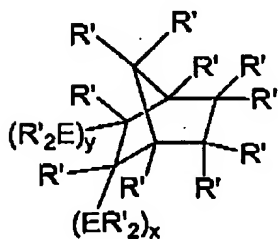
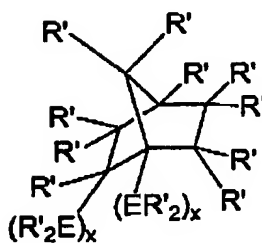
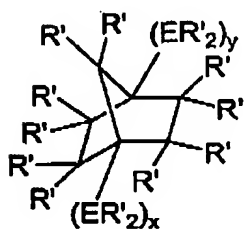
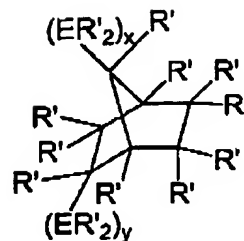
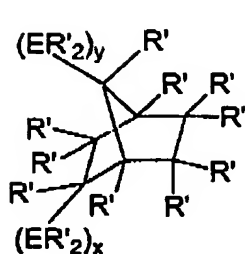
R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, and R<sup>4</sup> are hydrocarbyl radicals;

each X is independently an abstractable ligand selected from the group consisting of hydride radicals; hydrocarbyl radicals; hydrocarbyl-substituted radicals, organometalloid radicals; aryloxy, amide, or phosphide radicals; or the two X's are connected to form a 3-to-50-atom metallacycle ring; and

The composition of matter of Claim 14 wherein Y has one of the following formulas:







where

$R'$  are hydrogen or  $C_1$ - $C_{50}$  hydrocarbyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4; and

y is an integer from 0 to 4.

17. (Previously Presented) The composition of Claim 16 wherein A is C=O, C=S, O, S, SO<sub>2</sub>, NR\*, PR\*, BR\*, SiR\*<sub>2</sub>, or GeR\*<sub>2</sub> wherein each R\* is a hydrocarbyl or halocarbyl radical.

18. (Withdrawn) A composition of matter comprising the reaction product of an activator and the composition of matter of Claim 2.

19. (Withdrawn) A composition of matter comprising the reaction product of

- (a) the composition of matter of Claim 18 and
- (b) ethylene, propylene, 1-butene, or a mixture of any two or all three of ethylene, propylene, and 1-butene.

20. (Withdrawn) A polymerization method comprising the step of providing at least one composition of matter of Claim 2.

21. (Previously Presented) The polymerization method of Claim 20 wherein the activity of the composition of matter exceeds 8000 moles of ethylene per mole transition metal per hour.

22. (Previously Presented) The polymerization method of Claim 20 further comprising recovering a product comprising greater than 50 wt% of linear C<sub>4</sub>-C<sub>14</sub> α-olefins based on the total weight of polymerized product.

23. (Withdrawn) The polymerization method of Claim 22 wherein the product comprises greater than 80 wt% of linear C<sub>4</sub>-C<sub>14</sub> α-olefins.

24. (Withdrawn) The polymerization method of Claim 23 wherein the product comprises greater than 50 wt% of linear C<sub>4</sub> and C<sub>6</sub>  $\alpha$ -olefins.

25. (Withdrawn) The polymerization method of Claim 24 wherein the product comprises greater than 80 mol% of linear C<sub>4</sub> and C<sub>6</sub>  $\alpha$ -olefins.

26. (Previously Presented) A composition of matter comprising the reaction product of:

(a) an activator; and

(b) a catalyst precursor with the formula of the composition of matter of claim 2, wherein:

(i) M is iron, nickel, or cobalt; and

(ii) R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, and R<sup>4</sup> are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

27. (Previously Presented) A composition of matter comprising the reaction product of:

(a) an activator; and



(b) a catalyst precursor with the formula of the composition of matter of claim 2 wherein:

(i) M is nickel, iron, cobalt, platinum, ruthenium, rhodium, or iridium;

(ii)  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals; and

(iii) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form a 3-to-40-atom metallacycle ring.

28. (Currently Amended) The composition of matter of claim 27 wherein

(i)  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are independently selected from methyl, ethyl, and ~~propyl~~, propyl; and

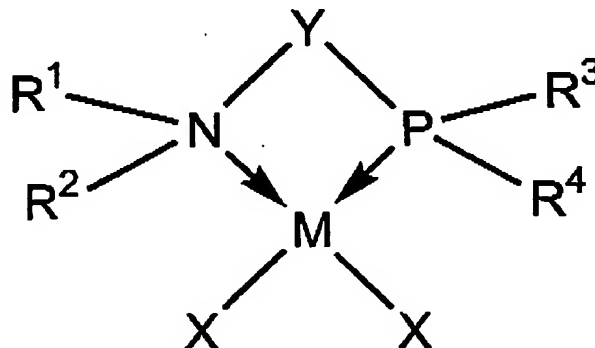
(ii) Y is selected from butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene,

pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penenylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals; radicals.

**29. (Currently Amended) A composition of matter comprising the reaction product of:**

(a) an activator; and

(b) a catalyst precursor with the formula of the composition of matter of claim 2, wherein: following formula:



wherein

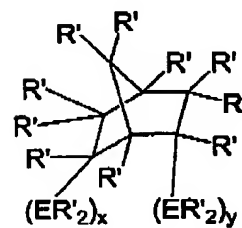
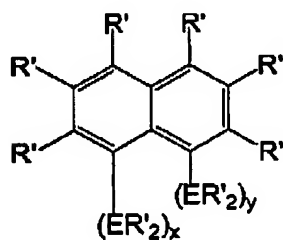
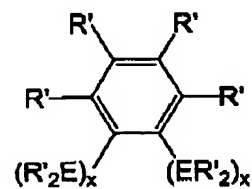
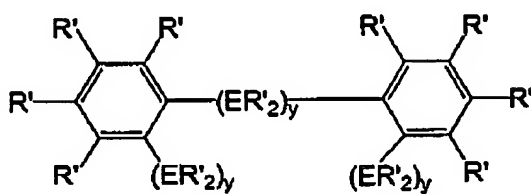
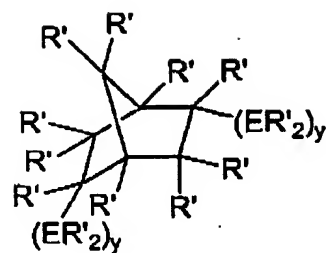
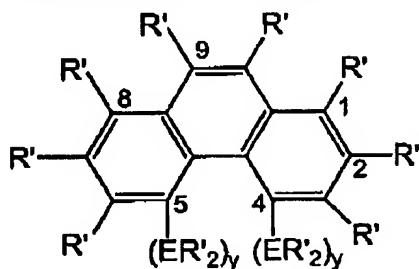
M is a Group-8, -9, or -10 transition metal, excluding palladium.

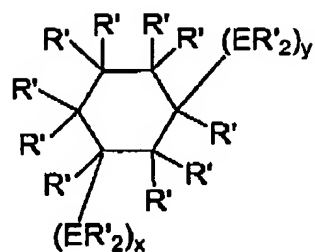
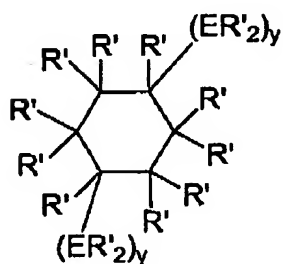
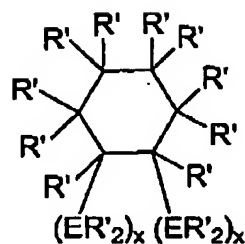
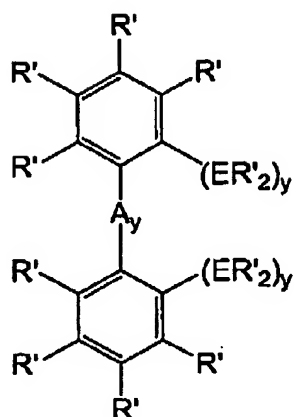
N is nitrogen;

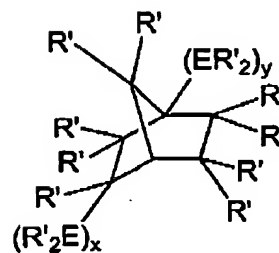
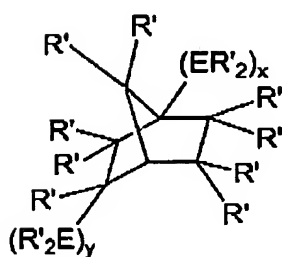
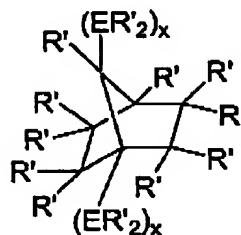
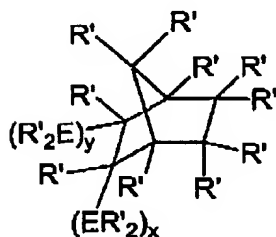
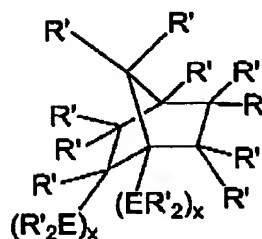
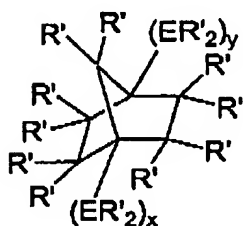
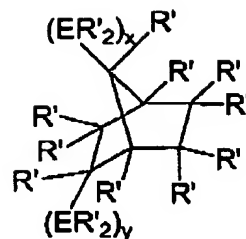
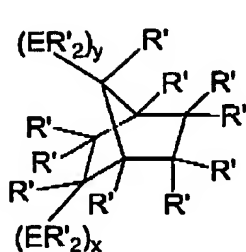
P is phosphorus;

$R^1, R^2, R^3$ , and  $R^4$  are hydrocarbyl radicals;

Y is represented by one of the following formulas:







where

- R' are independently, hydrogen or C<sub>1</sub>-C<sub>50</sub> hydrocarbyl radicals;
- A is a non-hydrocarbon atom functional group;

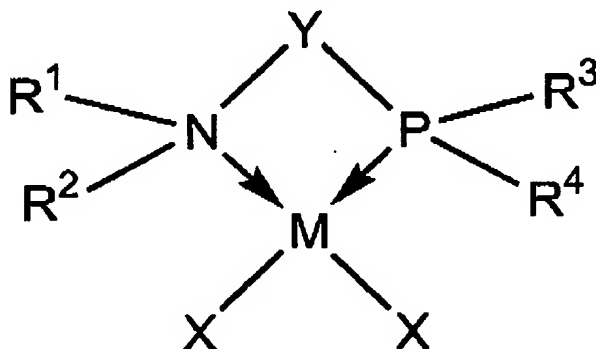
- E is a Group-14 element;
- x is an integer from 1 to 4;
- y is an integer from 0 to 4; and

X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, diethylamino, methylethylaminodimethylamin; or two X's are connected to form a 3-to-40-atom metallacycle ring.

30. (Previously Presented) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

(a) an activator; and

(b) a catalyst precursor with the following formula:



wherein

- (i) M is iron, nickel, or cobalt,
- (ii) N is nitrogen;

(iii) P is phosphorus;

(iv)  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;

(v) Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long; and

(vi) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form a 3-to-40-atom metallacycle ring.

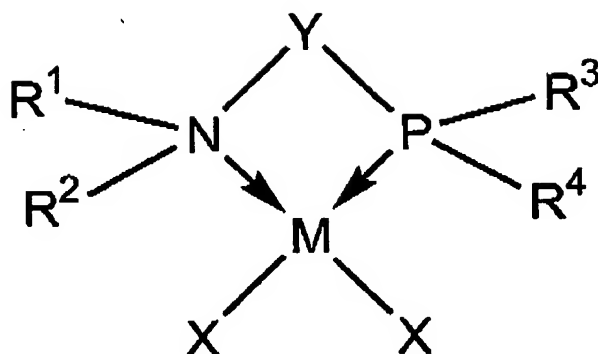
31. (Previously Presented) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

(a) an activator; and

(b) a catalyst precursor with the following formula:

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wherein

- (i)  $M$  is nickel, iron, cobalt, platinum, ruthenium, rhodium, or iridium;
- (ii)  $N$  is nitrogen;
- (iii)  $P$  is phosphorus;
- (iv)  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;
- (v)  $Y$  is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long; and
- (vi)  $X$  are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl,



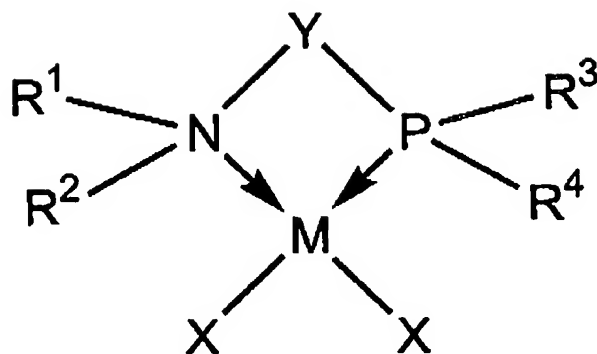
eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino or two X's are connected to form a 3-to-40-atom metallacycle ring.

32. (Previously Presented) The polymerization method of claim 31 wherein Y is a butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclododecylene, cyclododecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, or dodecatrienylene radical.

33. (Previously Presented) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

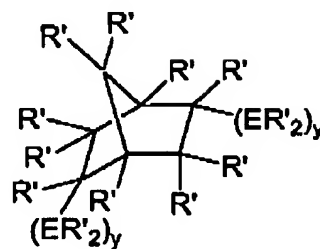
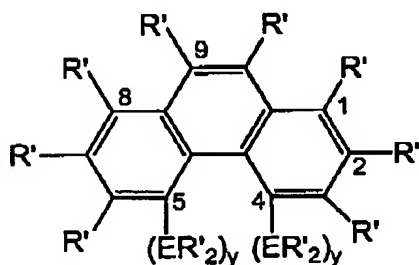
(a) an activator; and

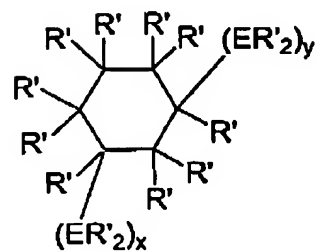
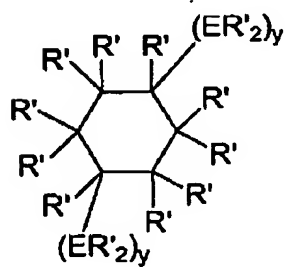
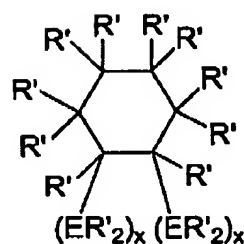
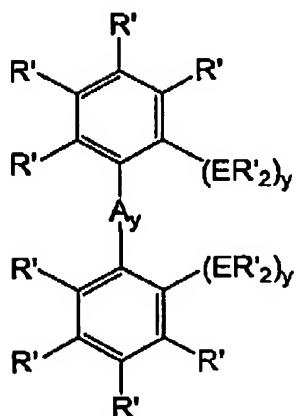
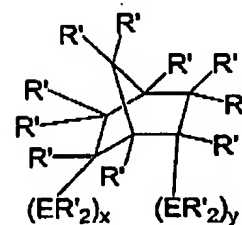
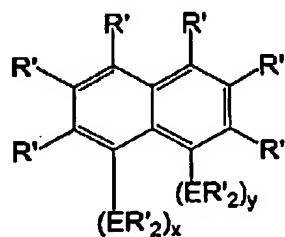
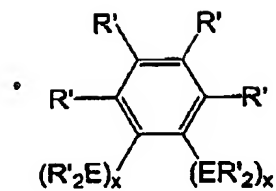
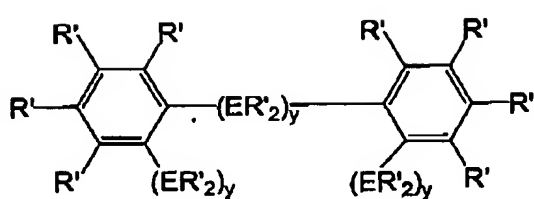
(b) a catalyst precursor with the following formula:

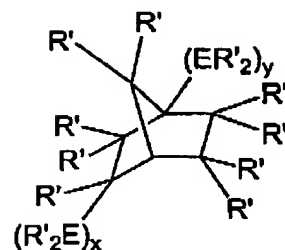
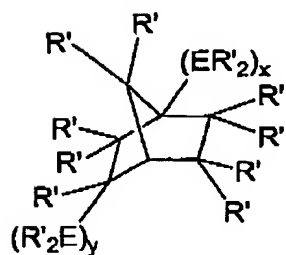
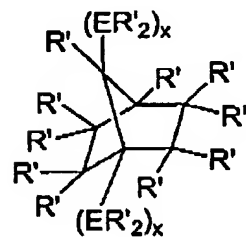
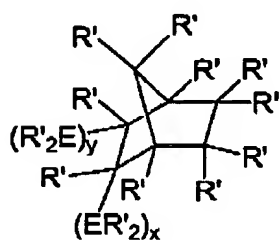
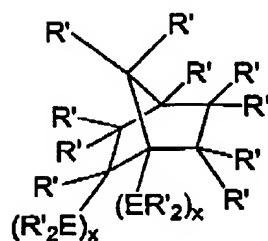
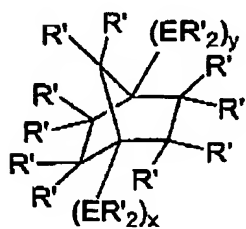
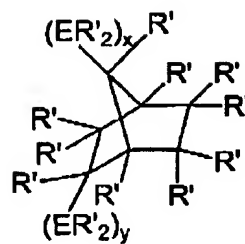
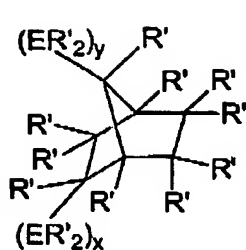


wherein

- (i) M is a Group-8, -9, or -10 transition metal,
- (ii) N is nitrogen;
- (iii) P is phosphorus;
- (iv)  $R^1$ ,  $R^2$ ,  $R^3$ , and  $R^4$  are independently hydrocarbyl radicals;
- (v) Y is represented by one of the following formulas:







Where

- R' are independently, hydrogen or C<sub>1</sub>-C<sub>50</sub> hydrocarbyl radicals;
- A is a non-hydrocarbon atom functional group;
- E is a Group-14 element;
- x is an integer from 1 to 4; and
- y is an integer from 0 to 4 ~~and~~; 4; and

(vi) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, or methylethylamino.